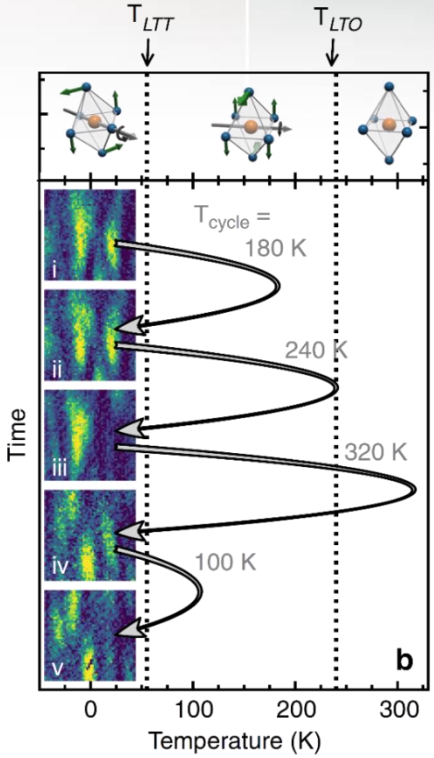
CDW Memory in a Cuprate Superconductor



Different crystal configurations (top) and measured CDW speckle patterns (left) at different temperatures. The graphic illustrates how the patterns change once the cycling crosses above T_{LTO}.

X.M. Chen, Y. Cao, C. Mazzoli, V. Thampy, A.M. Barbour, W. Hu, M. Lu, T. Assefa, H. Miao, G. Fabbris, G. D. Gu, J. M. Tranquada, M.P.M. Dean, S.B. Wilkins, I.K. Robinson, *Nat. Comms.* **10**:1435, 1-6 (2019).

Scientific Achievement

Scientists revealed that the charge density wave (CDW) stripe domains in the high-temperature superconductor (HTSC) $La_{1.875}Ba_{0.125}CuO_4$ display a memory effect where the same domain configuration is reproduced after cycling above the CDW transition temperature.

Significance and Impact

This work showed that the charge order is fixed by pinning centers that set in at much higher temperatures. This provides an additional constraint on theories of superconductivity in these materials.

Research Details

- Samples were prepared and imaged at the Center for Functional Nanomaterials.
- Soft x-ray coherent diffraction at the NSLS-II CSX beamline measured the CDW domain configuration.
- By measuring after temperature cycling, it was possible to associate the pinning process with structural phase transitions well above the transition temperature.